

## CLAIMS

1. An internal combustion engine comprising:
  - a housing;
  - an intake port defined in the housing;
  - 5 an exhaust port defined in the housing;
  - a generally cylindrical combustion chamber defined in the housing and communicating with the intake port and the exhaust port; and
  - a combustion geroter received by the combustion chamber and rotatable therein to receive a fuel mixture, compress the fuel mixture, combust the fuel mixture,
  - 10 and discharge the combusted fuel mixture to the exhaust port.
2. The internal combustion engine of claim 1, wherein the combustion geroter includes an inner gear and an outer gear that rotate within the combustion chamber, wherein the inner gear rotates about a first axis, and the outer gear rotates about a second axis that is spaced from and substantially parallel to the first axis.
- 15 3. The internal combustion engine of claim 2, wherein the inner and outer gears cooperate to define a plurality of ignition chambers that receive the fuel mixture, and wherein the ignition chambers increase and decrease in volume as the inner and outer gears rotate.
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4. The internal combustion engine of claim 3, wherein the combustion chamber includes an aperture defined in the geroter housing and positioned to communicate with the ignition chambers when the ignition chambers are at a maximum volume and when the ignition chambers are decreasing in volume, and  
5 wherein the fuel mixture flows through the aperture and into the ignition chambers.

5. The internal combustion engine of claim 3, wherein the exhaust port includes an aperture that is positioned to communicate with the ignition chambers when the ignition chambers are increasing in volume.

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6. The internal combustion engine of claim 1, wherein the fuel mixture is combusted due to a pressure increase that occurs as the fuel mixture is compressed by the combustion geroter.

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7. The internal combustion engine of claim 1, further comprising a spark plug positioned in the combustion chamber to combust the fuel mixture as the combustion geroter compresses the fuel mixture.

8. The internal combustion engine of claim 1, further comprising:  
a generally cylindrical compression chamber defined in the geroter housing  
and communicating with the intake port;  
an intermediate manifold providing communication between the compression  
5 chamber and the combustion chamber;  
a compressor geroter received by the compression chamber and rotatable  
therein to receive the fuel mixture from the intake port, compress the fuel mixture,  
and discharge the compressed fuel mixture to the intermediate manifold; and  
a drive shaft coupling the compressor geroter and the combustion geroter for  
10 rotation together, wherein the combustion geroter receives the compressed fuel  
mixture from the intermediate manifold.

9. The internal combustion engine of claim 8, wherein the compressor  
geroter includes an inner gear and an outer gear that rotate within the compression  
15 chamber, wherein the inner gear rotates about a first axis, and the outer gear rotates  
about a second axis that is spaced from and substantially parallel to the first axis.

10. The internal combustion engine of claim 9, wherein the inner and outer  
gears cooperate to define a plurality of charge chambers that receive the fuel mixture,  
20 and wherein the charge chambers increase and decrease in volume as the inner and  
outer gears rotate.

11. The internal combustion engine of claim 10, wherein the intake port includes an aperture defined in the geroter housing and positioned to communicate with the charge chambers when the charge chambers are increasing in volume.

5 12. The internal combustion engine of claim 10, wherein the intermediate manifold includes an aperture defined in the geroter housing and positioned to communicate with the charge chambers when the charge chambers are decreasing in volume.

13. A method for rotatably driving a drive shaft comprising:  
providing a geroter having an inner gear coupled to the drive shaft and an  
outer gear engaging the inner gear;  
delivering a fuel mixture to the geroter;  
5 compressing the fuel mixture in the geroter;  
combusting the compressed fuel mixture in the geroter;  
expanding the combusted fuel mixture in the geroter to drivingly rotate the  
geroter and the drive shaft; and  
discharging the expanded fuel mixture from the geroter.

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14. The method of claim 13, further comprising:  
providing an upstream geroter having an inner gear coupled to the drive shaft  
and an outer gear engaging the inner gear;  
pre-compressing the fuel mixture in the upstream geroter; and  
15 communicating the pre-compressed fuel mixture from the upstream geroter to  
the geroter.

15. The method of claim 14, wherein compressing the fuel mixture in the  
geroter comprises further compressing the pre-compressed fuel mixture in the geroter.

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16. The method of claim 13, wherein providing a geroter includes providing an outer gear having  $N$  convex surfaces, and an inner gear having  $N-1$  concave surfaces, and wherein  $N-1$  compressed fuel mixtures are combusted during each inner gear rotation.

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17. The method of claim 13, wherein combusting the compressed fuel mixture in the geroter comprises combusting the compressed fuel mixture in response to a pressure increase of the compressed fuel mixture.